Microsc. Microanal. 19 (Suppl 4), 2013

doi:10.1017/S1431927613001189

Salt weathering of limestones: susceptibility of petrographical features (SEM study)

C. Alves*, C. Figueiredo**, A. Maurício** and L. Aires-Barros**

*Centro de Investigação Geológica, Ordenamento e Valorização de Recursos, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal
**Centro de Petrologia e Geoquímica, Instituto Superior Técnico, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal

Salt weathering is one of the main processes affecting rock materials applied in the built environment. Scanning electron microscopy (SEM) studies can contribute to the understanding of the susceptibility of petrographic features of rocks to salt weathering.

SEM studies were performed in limestones (grainstones with the commercial designations of Semi-rijo and Moca Creme and a travertine, geological details in [1-3]) submitted to salt weathering tests (EN 12370 using sodium sulphate solutions and cubic specimens) consisting of 15 cycles of immersion/drying followed by water washing after the 15th cycle. Fragments from small cubes of the grainstones subjected to salt weathering cycles without the final water cleaning were also studied. SEM observation before and after the tests allows the discussion of the petrographical characteristics of these rocks that contribute to erosive decay under salt weathering.

In the case of the grainstones specimens the texture can be described in general as allochemical particles cemented by sparry calcite (Figure 1 a) and it is visible from the preparation of the polished surfaces the interface between the sparry cement and the allochemical components. After the salt weathering tests, SEM studies show (Figure 1 b) extensive fissuring in the sparry cement and separation between grains and sparry cement. Observations of disaggregation products showed an important amount of apparently intact grains. These results are similar to those observed by [4] with the sparry cement being affect by salt crystallisation and lesser impact on the grains. Studies in the unwashed specimens showed the presence of sodium sulphate in the interface between allochemical grains and the sparry cement (Figure 1 c,d). Travertine specimens show heterogeneous patterns of erosion attributed to the heterogeneous texture of this rock, with more terrigenous (especially clay-rich) portions that favour a higher erosive susceptibility [1] and the presence of clays has been frequently connected with salt weathering susceptibility in limestones [5]. In Figure 1e can be observed the heterogeneity of a polished surface, with the more irregular portions showing a chemical spectra (Figure 1 f) indicative of the terrigenous component and the presence of sodium and sulphate (resulting from the solutions used in these weathering tests).

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The authors acknowledge the support of the Fundação para a Ciência e Tecnologia (POCTI/CTA/44940/2002; PEst-OE/CTE/UI0697/2011 and Pest-OE/CTE/UI0098/2011, funding by the European Union and national budget of the Portuguese Republic). Acknowledgments to Eng. Teresa Luís, Eng. Sónia Pereira and Enterprise Mármores Galrão for the rock blocks.

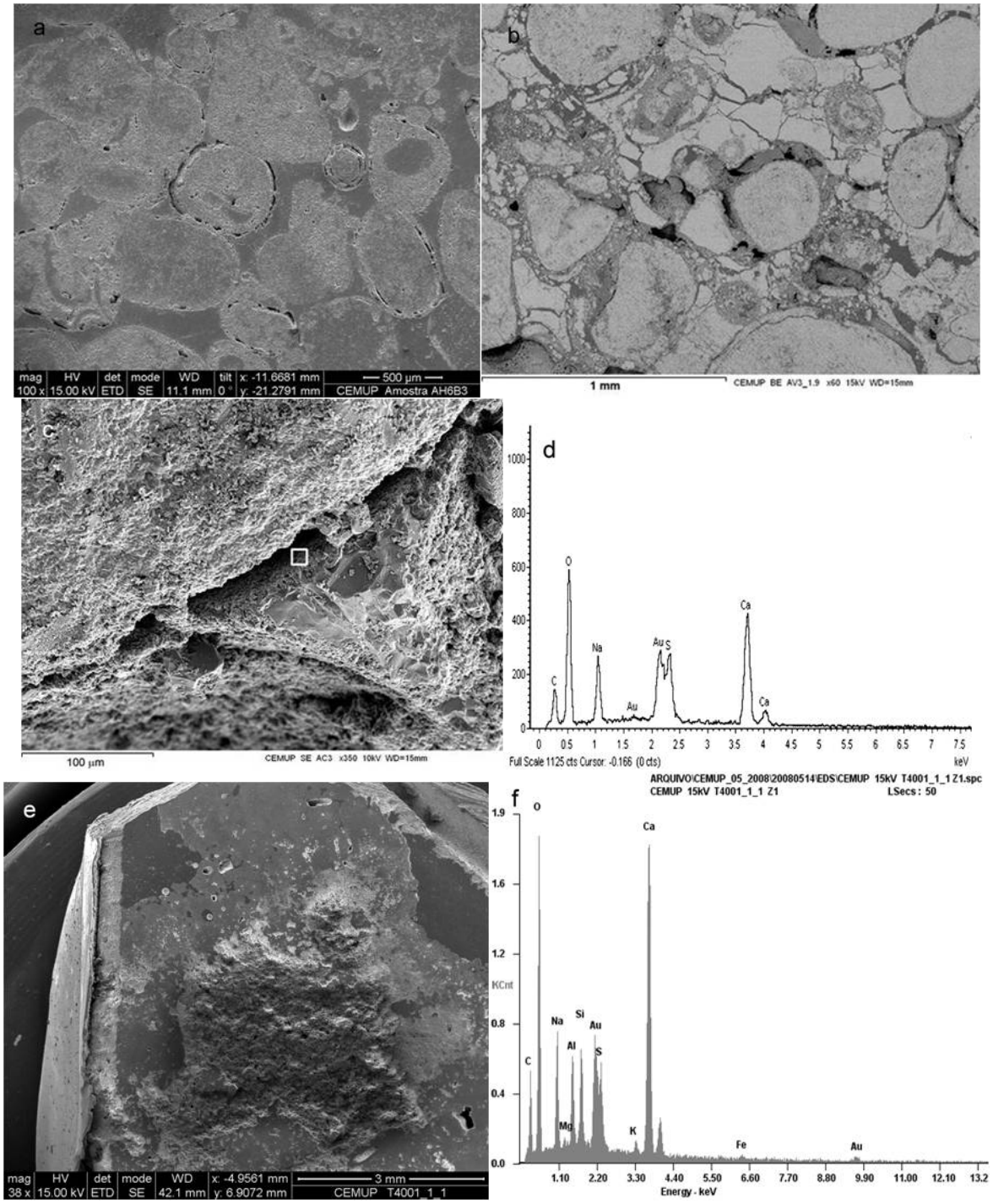

Figure 1. SEM studies of the susceptibility of limestone petrographical features to salt weathering: a) grainstone texture before salt weathering tests showing grains cemented by sparry calcite, b) intense fissuring of sparry calcite and grains separation after salt weathering test on grainstones; c) sodium sulphate in the interface between sparry cement and grains; d) spectrum of c), e) heterogeneous surface of travertine after salt weathering test; f) spectrum of the more irregular areas of travertine after salt weathering indicating terrigenous fraction and sodium sulphate. SEM studies performed at CEMUP laboratory (University of Oporto, Portugal).

https://doi.org/10.1017/S1431927613001189 Published online by Cambridge University Press